

Test Plan for Testing the Real Time Fingerprint Positioning Library (RTFPPL) for Retail Phase II

Ver 1.1

Document History

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| April 27, 2016 | 1.0 | Document created. Added Introduction and Functional Testing chapters. |
| April 28, 2016 | 1.1 | Added Performance Testing chapter (unfinished). |
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# Introduction

The purpose of this Test Plan is to define testing procedures for testing the functionality and performance of the Real Time Fingerprint Positioning Library (RTFPPL). This library is used to provide real time user position for indoor areas based on previously collected specific fingerprints of those areas and real-time data from smartphone or other mobile device sensors.

Since intended test item is a software library, additional tools are required for testing. Therefore the actual test item is a PC application which uses RTFPPL functions to calculate user position based on input data. Some tests are performed using artificial modeled data generated by a PC application, while other tests require real data from smartphone sensors.

Functional testing is the crucial part of the proposed testing procedures, since the top priority is to make sure that RTFPPL provides adequate user position in all scenarios.

Testing the library output position accuracy under a set of conditions is a part of proposed testing procedures, however it is important to note that RTFPPL performance depends on the quality of input data.

# Functional Testing

## Test Items

Test item is a PC application – RTFPPL Testing Application (Test App). This application uses RTFPPL and operates in post-processing mode only.

## Features to be Tested

|  |  |  |
| --- | --- | --- |
| **Test Number** | **Feature to Test** | **Test Description** |
| 1 | Calculating user position based on Wi-Fi measurements input data | Tester collects data while moving across test area and then runs Test App on PC. Tester checks that Test App is able to provide output track based on Wi-Fi measurements input data and existing Wi-Fi fingerprint for test area. |
| 2 | Calculating user position based on magnetometer measurements input data coupled with position and orientation input data from PDR algorithm | Tester collects data while moving across test area and then runs Test App on PC. Tester checks that Test App is able to provide output track based on magnetometer measurements input data coupled with position and orientation data and existing magnetic fingerprint for test area. |
| 3 | Calculating user position based on mixed input data (both Wi-Fi measurements and magnetometer measurements coupled with position and orientation input data from PDR algorithm) | Tester collects data while moving across test area and then runs Test App on PC. Tester checks that Test App is able to provide output track based on both Wi-Fi measurements input data and magnetometer measurements input data coupled with position and orientation data and existing magnetic and Wi-Fi fingerprints for test area. |

## Test Procedure

1. A test area is chosen.
2. Tester collects Wi-Fi FP and MFP for the test area using external tools that provide fingerprints in formats compatible with the RTFPPL version under testing. Tester sets Wi-Fi FP cell size to 2.5 meters and MFP cell size to 1.0 meter in the FP generating PC tool.
3. Tester uploads both fingerprints to a PC.
4. Tester uses an Android application running on a smartphone to collect data from 5 test tracks while moving across the test area. During each track tester makes a total of no less than 50 steps. Each track should start and end at different locations in the test area. Tester depicts approximate trajectory for each track on separate image file with floor plan of the test area.
5. Tester uploads collected data to a PC.
6. Tester launches Test App on PC and sets all the input test area parameters (venue size and each fingerprint’s name and MFP cell size).
7. Tester runs Test App on all test tracks while setting it to use Wi-Fi FP data only. Tester checks that Test App output track exists for each test and that it resembles the actual track.
8. Tester repeats item 7 while setting Test App to use MFP data only and then to use both MFP and Wi-Fi data.
9. Tester marks the result of each of the 15 tests in the test report.

## Test Pass/Fail Criteria

Test item (Test App) is considered to have passed the test if output track resembles the real track.

For tests using MFP data only the Test App provides position only after approximately 12-15 steps of the track (for test area size specified in Environmental Needs). This is considered to be a normal behavior of the MFP positioning algorithm and does not lead to a test failure.

Test item is considered to have failed the test if output track is not generated or if it significantly differs from the real track.

## Test Deliverables

Test report should be provided by tester after the functional testing is completed. Test report must contain Test item version, description of the test area and a table with test results.

## Environmental Needs

-Test item (Test App for PC).

-TPN Android application running on Nexus 5 or Samsung Galaxy S6 smartphone with Android version of 5.0 or higher.

-Test area with recommended size about 300-600 square meters.

-Android application for collecting FP data and PC tools for generating FP from it.

# Performance Testing

## Test Items

Test item is a PC application – RTFPPL Testing Application (Test App). This application uses RTFPPL and operates in post-processing mode only.

## Features to be Tested

|  |  |  |
| --- | --- | --- |
| **Test Number** | **Feature to Test** | **Test Description** |
| 1 | Wi-Fi only output position accuracy for a given Wi-Fi FP in the test area | Tester collects data for a Wi-Fi FP using auxiliary FP building tools.  Then tester collects data while moving across test area and then runs Test App on PC. Tester uses additional tool to estimate the accuracy of Test App positioning output in Wi-Fi only mode. |
| 2 | MFP only output position accuracy for artificial input data | Tester uses PC application which generates artificial MFP and tracks to estimate the accuracy of Test App positioning output in MFP only mode. |

## Test Procedure

For performance test number 1:

1. A test area is chosen.
2. Tester collects Wi-Fi FP for the test area using external tools that provide fingerprints in formats compatible with the RTFPPL version under testing. Tester crosses each 2.5x2.5 square of the test area 10 times during FP data collection. Tester sets Wi-Fi FP cell size to 2.5 meters in the FP generating PC tool.
3. Tester selects at least 7 points in the test area (checkpoints), orders them and marks their positions and index numbers on the floor plan.
4. Tester uses an Android application running on a smartphone to collect data from 10 test tracks while moving across the test area. While recording each track tester visits every checkpoint location according in order and stops for at least 5 seconds at each such location. Tester should not make any other stops longer than 2 seconds while recording the tracks.
5. Tester uploads collected data to a PC.
6. Tester launches Test App on PC and sets all the input test area parameters (venue size and Wi-Fi fingerprint’s name).
7. Tester runs Test App on all test tracks while setting it to use Wi-Fi FP data only.
8. Tester inputs real coordinates of each checkpoint to a file and uses auxiliary PC tool to analyze each generated output track from the Test App.
9. This PC tool compares positions at checkpoints calculated by Test App to the real positions of checkpoints. It calculates errors at each checkpoint for each track as well as average error at each checkpoint for all tracks and position availability for each checkpoint.
10. Tester marks the results of 9 in the test report.

For performance test number 2:

1. Tester uses a special PC tool (MFP generator) to create an artificial MFP. The recommended MFP size is 1000-1500 square meters.
2. Tester creates <number> of scripts to use in another PC tool (MFP Testing Model). Each of those scripts must simulate movement across the area with the generated MFP.

Each track should be at least 2 minutes long with constant simulated velocity of about 1 m/s.

Each track should contain a number of simulated rotations of both user trajectory and the device starting from 0 for the first track and gradually increasing until the <maximum number> for the last track.

1. Tester uses another PC tool (MFP Testing Model) to generate <number> of files with data for <number> artificial tracks from those script files.

All of those files contain artificial position, orientation and magnetometer data in the input format of Test App.

<Several> sets of files must be generated. Additional position and orientation errors should vary from 0 in the first set to insert numbers in the last set.

## Test Pass/Fail Criteria

## Test Deliverables

Test report should be provided by tester after the functional testing is completed.

## Environmental Needs

# Appendix A: Key Terms